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BANK PERFORMANCE AND SUPERVISION IN NIGERIA: ANALYSING THE TRANSITION TO A DEREGULATED ECONOMY

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Bank performance and supervision in Nigeria: Analysing the transition to a deregulated economy*

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Abstract

This study focuses on the effect of gradual deregulation in a developing economy on the efficiency of banks and the banking sector. It assesses whether the policy package results in an improvement in the technical efficiency of the industry. This study adopts the data envelopment analysis (approach) that has been used to assess intertemporal changes in efficiency as well as the relative inefficiency of government controlled banks compared with private (new generation) banks. The study found that banking industry efficiency declined significantly during the years immediately following the adoption of deregulation, with slight improvements noticed only in recent times. The study concludes that this may be the effect of inconsistent policies to which the sector was subjected during this period.

I. Introduction and background

As the prime movers of economic life, banks occupy a significant place in the economy of every nation. It is therefore not surprising that their operations are perhaps the most heavily regulated and supervised of all businesses (Soyibo and Adekanye, 1991). The importance of Nigerian banks is exemplified by their prominence in the structural adjustment programme (SAP) embarked upon by the nation in July 1986. Among other things banks were accredited as the only authorized dealers at the official segment of the multiple exchange that which have existed since the second-tier foreign exchange market (SFEM) was introduced. Also, the scope and coverage of their operations was seen as appropriate for the effective implementation of monetary policy and the intended reform. Through their financial intermediation function and the spread of bank branches, they were relied on to take result-oriented approach to export promotion and diversification and the revamping of industrial development and growth in Nigeria. The sectoral credit allocation policy, the National Economic Reconstruction Fund (NERFUND), the Nigeria Export-Import Bank (NEXIM) and the African Development Bank's Export Stimulation Loan (ADB/ESL) are among the endeavours to enhance the ability of banks to achieve the desired results for the overall benefit of the national economy.

Policy makers, economists and monetary authorities recongnize that the ability of banks to achieve the desired results and to continue to play the role earmarked for them depends not only on the existence of an enabling (regulatory) environment and the number of operating banks (and perhaps the spread of bank branches) but more importantly on their performance from one financial year to the other. Quite obviously, the greater the number of operating banks that are resistant to adverse financial conditions, the better for monetary policy and ultimately the economy. The performance of banks attracts considerable attention from bank regulators and monetary authorities for this reason and also because of the adverse implications that bank failures would have public confidence in the banking system. This is why from country to country such classifications as problem/non-problem (Sinkey, 1975a), failed/surviving (Siems, 1992), financially successful/non-financially successful (Arshadi and Lawrence, 1987) and vulnerable/ resistant (Korobow and Stuhr, 1975; Hunter and Srinivasan, 1990; Adekanye, 1993) have been used to distinguish the performance of banks. In recent times, the monetary authorities in Nigeria have classified banks as healthy or distressed in an attempt to distinguish the performance of the country's banks. For the majority of the so-called distressed banks, some steps are taken to minimize the potential impact on the banking system and the economy of eventual failure though the primary desire is that they ultimately revert to sound health.

The financial deregulation[1] and liberalization policy came as a major component of the broad economic restructuring programme. In the early periods of the implementation of the programme and policy, many more banks, both merchant and commercial, gained entry into the sector. Ever since this period, other non-bank financial institutions such as finance companies, securities firms, community banks, the People's bank and lately mortgage banks, have become part of the financial system. Such specialized banks as NEXIM and the Urban Development Bank (UDB) have also commenced operations. However, to the extent that the conventional banks still hold the bulk of financial system deposits, provide the most appropriate channel through which monetary policy can be effectively conducted, coordinated, monitored and assessed, and serve as bankers to other financial institutions, they constitute, as in many other developed and developing economies, the most important group of financial institutions. By implication, therefore, they attract the greatest attention and, indeed, the most supervision. The myriad of guidelines and components of monetary policy directed at them in the form of interest rate ceilings, floors and maximum spreads, the prudential guidelines, paid-up capital enhancement, adherence to the international capital adequacy ratio prescribed by the Basle Committee, credit expansion ceilings, and directed credit guidelines, attest to the identified need for effective supervision deriving from the identified importance of these banks. Again, banking supervision ties in with the interest of monetary authorities in bank performance explained by the distinguishing performance classifications.

While there have been claims that Nigerian banks have performed better since deregulation, some others have maintained that this applies only to private rather than public banks. The call for a divestment of government interest in Nigerian banks has been made in line with the policy thrust of the SAP. Due essentially to bureaucracy and inefficiencies, the policy of privatization of government parastatals was incorporated into the economic restructuring programme to correct some of the distortions that characterized the economy and to aid effective resource allocation. From another perspective, it has been argued that continued government involvement in the ownership and operation of banks, especially the larger ones (which by their age account for about 40% of the total assets of all banks), hindered their effective supervision thereby increasing the risk of failure and erosion of public confidence in the banking system. Adekanye (1993) pointed out that the very poor financial condition of National Bank of Nigeria had been evident since the early 1980s but the Central Bank of Nigeria (CBN) seemed to have hesitated to take prompt corrective action due to government's involvement in the bank. Government, it seems, had been reluctant to privatize the banks due to the perceived sensitive nature of the sector to the economy and the need to maintain visibility. Only recently has the attempt been made to privatize some of the banks, and only few a have been privatized so far.

Bank performance, its determinants, classification and trends over the transition from a regulated to a deregulated economy, as well as the demands the transition makes on the supervisory authorities, requires greater attention. More than ever before, the preparedness and ability of the CBN to effectively supervise and conduct monetary policy in the resultant unprecedented expansion is under question. To live up to expectation, bank examiners, supervisors and policy makers require a more comprehensive understanding of the

performance characteristics of banks, the factors that determine their performance and the effect of deregulation on their performance.

Justification and need for the study

While there have been very many studies aimed at isolating the characteristics, behaviour and performance determinants of banks in developed countries, there are few that focus on developing countries of Africa, and indeed, in Nigeria. The behaviour of banks and the determinants of bank performance should be thoroughly investigated and appreciated for monetary policy effectiveness to be assured, for appropriate policy instruments to be designed and adopted, and for the all important banking supervision function of the CBN and other supervisory bodies such as the Nigeria Deposit Insurance Corporation (NDIC) to have the necessary impact. The importance of studies in this area cannot be overemphasized, especially at a time when (1) the banking sector has expanded considerably in both size and scope of operation without an obvious matching increase in supervisory resources, (2) it is believed the seemingly haphazard trial and error approach to policy formulation has jeopardized the ability of management of banks to effectively manage their asset and liability portfolios, and (3) when the impact of SAP on very many activities including those of banks and on the economy is not yet known.

Adekanye (1993) represents a notable attempt to isolate the factors that distinguish vulnerable from resistant commercial banks in Nigeria. The study, which covered 1984 to 1989 and adopted both multivariate discriminant analysis (MDA) and the logit regression technique, confirmed managerial efficiency to be the overriding determinant of commercial bank performance in Nigeria. Notwithstanding the illuminating evidence, the observed sample and other limitations of this study, policy developments since 1989, and the availability of more promising methodologies make further research not just desirable but imperative.

The study concentrated on commercial banks and specifically the few that operated prior to the adoption of SAP. As it covered only five of the seven years of deregulation, the study should not be relied on for policy formulation. Essentially relying on financial ratios, the study–like many others–used managerial efficiency as a proxy for management quality. As Siems (1992) pointed out, the single ratios measuring managerial efficiency such as operating income to operating expenses, suffer from several limitations. Though they may provide an overall measure of operational efficiency, they fail to indicate resource allocation and product decisions made by management because both the numerator and denominator are aggregate measures. Also, when a host of non-aggregated single input-output ratios are used to assess the myriad of decisions made by management, the ratios collectively represent a morass of numbers that give no clear evidence of efficiency of a bank (Siems, 1992; Sexton, 1986). One ratio may show that a bank is highly efficient while another displays a highly inefficient operation. Sexton maintains that such ambiguity makes ratio analyses ineffective in measuring true efficiency.

Our study covers the investigation of efficiency as a measure of bank performance and includes more banks than Adekanye incorporated in his study, including the new

generation banks. Adekanye's survey of of bank managers revealed that many were of the view that bank failure is imminent and many of the new banks will be the first to fall victim. There is a consensus in the literature that management quality is the ultimate determinant of a bank's long-term survival (Cates, 1985; Pantallone and Platt, 1987; Horner, 1988; Seballos and Thompson, 1990; Siems, 1991). An interesting issue is the quality of the management of the new banks relative to the older and bigger banks and whether significant changes have took place in the transition to a deregulated economy. A similar analysis will provide a platform for assessing the nature of the inefficiency of public banks and perhaps form a basis in conjuction with other factors for prioritizing the privatization of these banks. Significant differences in efficiency between public and private banks, if they exist, can be established to further justify or refute the need for privatization of these banks. Furthermore, the time frame of the analysis provides a basis for investigating the impact of SAP on the performance (efficiency) of banks. Data envelopment analysis (DEA), an approach recently applied to the assessment of efficiency of banking institutions and the significance of management quality (measured quantitatively) as a determinant of bank performance (Siems, 1992; Yue, 1992), provides the framework within which the highlighted issues have been investigated.

The appropriateness of the classification criteria adopted by the monetary authorities to distinguish the performance of banks and the consequences of such distinction have been examined and questioned (Sobodu, 1993a). The efficiency of these banks measured quantitatively could help to assess objectively the appropriateness of the criteria and perhaps also provide a basis for the modification of same. If this is achieved, the study would have contributed to policy formulation and would enhance significantly the supervisory procedures, resource allocation and capability of the authorities.

The issues raised are of immense importance. The study provides a basis to investigate and evaluate the effect of SAP or, better still, the policy of financial deregulation on the management quality and efficiency of Nigerian banks. These issues have not been the focus in many of the studies. The DEA methodology has also not been applied to Nigerian banks. The increasingly complex nature of the banking system and the need to enhance the effectiveness of monetary policy and bank supervision in Nigeria make the study a desirable one.

Objectives of the study

The study has the following specific objectives:

- To analyse the significance of changes in management quality and the efficiency of Nigerian banks between 1983 and 1993.

- To measure the relative (in)efficiency of banks over time and across major categories, especially following deregulation in 1986.

- To assess the significance of the differences in technical efficiency between healthy and distressed banks (as to classified by the monetary authorities).

- To evaluate the significance of the DEA quantitative measure of technical efficiency as a proxy for management quality.

- To offer policy recommendations relating to the performance classification of Nigerian banks, the effect of deregulation on the efficiency of banks and the prospects for using efficiency measures to enhance banking supervision.

As part of the first objective, we compare the management quality measure with the managerial efficiency (ratio) measure in relative terms among banks and for each bank over the study period. This combined with a (rank) correlation analysis of the measures of bank efficiency will provide for an assessment of the suitability of managerial efficiency ratios as a proxy for management quality.

Policy recommendations that will be made are expected to aid the efficient allocation of supervisory resources and the resources of the Technical Committee on Privatisation and Commercialization (TCPC) now known as the Bureau for Public Enterprises (BPE), among others, as well as to preserve and encourage a sound and competitive banking system.

II. Bank performance related research: Empirical and methodological issues

The stream of bank failures experienced in the United States of America (USA) during the 1940s prompted considerable attention to bank performance. The attention has grown ever since. The establishment of the Federal Deposit Insurance Corporation (FDIC) was also the outcome of the interest of policy makers in the performance of banks. There have been efforts to identify bank failures and develop early warning systems capable of signalling imminent failure of banks early enough to improve the chances of survival and to minimize the impact on the depositors, the banking system and the economy if and when failure occurs. Research efforts have equally covered the identification of characteristics of problem banks, predictors and predictions of bank failures, and analysis of determinants of bank performance.

Performance classification has varied, with researchers' interests and banking systems reflecting why some studies used failed/non-failed classification as against vulnerable/ resistant classification. While some have represented ex post analysis, others have represented ex ante analysis. Following the definition or selection of appropriate performance criteria and categorization, financial ratios are often examined and analysed under groups reflecting different operating characteristics of banks. The popular categories include capital adequacy, asset quality, managerial efficiency (often used as a proxy for management quality), earnings (or profitability), and liquidity. Popular ratios for assessing capital adequacy include gross capital to total assets and gross capital to total loans. For asset quality, the ratios of total loans to total assets, loan loss provision to total loans and risk assets to total assets are commonly used. The ratios of operating income to operating expenses and operating expenses to total assets are commonly used to assess managerial efficiency. Profitability ratios include net income to total assets and net income to total capital, while for liquidity, total loans to total deposits and holding of government securities as a ratio of total assets are common. The list of ratios could indeed be endless.

Apart from financial information (derived essentially from financial ratios), other factors describing economic conditions, local market structure, demographic conditions and capital market information have been incorporated into the analysis of bank performance. Pettway and Sinkey (1980) and Shick and Sherman (1980) and Simons and Cross (1991) found information on bond and stock price movements of quoted commercial banks to be significant indicators of bank performance. The Nigerian capital market is still underdeveloped and more than 90% of banks are not quoted on the stock exchange. Hence, market information will be of limited use to us in Nigeria as a determinant of bank performance. Fraser et al. (1974) found both demographic and market structure factors to be significant determinants of bank performance and economic

factors to be insignificant. The latter confirms the differences that may exist in the behaviour of banks across banking markets and different economies. The demographic factors defined by Fraser et al. included total population, urban-rural mix of the population and population density, while the economic factors were growth in aggregate bank deposits, taxable non-farm payrolls, urban population and retail sales respectively. Pantalone and Platt (1987) defined the economic factors as percentage change in disposable income, residential construction, unemployment and population and found some of them significant determinants of bank performance in an era of deregulation.

A variety of methodologies are used to analyse bank performance. They include the CAMEL rating; univariate analysis (tests); multiple regression analysis; canonical correlation analysis; multivariate discriminant analysis (MDA); probit and logit techniques; survey approach and data envelopment analysis (DEA). We briefly highlight each of these approaches.

The CAMEL rating

The CAMEL rating is a scheme for grading the performance of banks by bank supervisors/ examiners during on-site examinations. These on-site examinations are designed to identify problems in individual banks and to ensure banks' compliance with existing laws and regulations. The acronym derives from the five major dimensions of a bank's operation: Capital adequacy, Asset quality, Management quality, Earnings ability and Liquidity (CAMEL). Examiners score each of these factors as a single number from 1 to 5, with 1 being the strongest rating, and develop an overall CAMEL rating from 1 to 5 from the factor scores. As a rule of thumb, banks with a CAMEL rating of 4 or 5 are considered to be problem banks. The rating system is applied widely in the USA especially due to its simplicity and use by regulators, although it is often complemented with more rigorous analysis.

Univariate analysis

This has involved an assessment of the significance of individual financial ratios by a statistical test of differences in means of each ratio between the two performance categories. Where the difference in means is found significant, the ratio is deemed a determinant or distinguishing factor of bank performance. This approach was adopted by Sinkey (1975a), Korobow and Stuhr (1975), and Adekanye (1993). A major limitation of the approach is that it does not recognize the possibility of joint significance of financial ratios. The multivariate approaches correct for this limitation.

Multiple regression analysis

Meyer and Pifer (1970) adopted this approach. They defined the dependent variable in the equation as a binary choice variable with 0 representing a failed bank and 1 representing

a solvent bank. The explanatory variables are real variables and parameter estimates in the equation are OLS estimates. While they are still unbiased, they are not efficient. The usefulness of this technique, in spite of this limitation, is observed from the conclusion that for the two-group case, the analysis and results would be similar to MDA. It will prove inappropriate, however, for a multiple choice dependent variable.

Multivariate discriminant analysis

This is a popular technique in bank performance literature. MDA attempts to identify the linear combination of independent variables (financial ratios and other measurable or choice factors) that best discriminates/distinguishes between two or more performance classifications. MDA is used to weight and linearly combine the discriminating variables in some fashion so that groups are forced to be as statistically distinct as possible (Klecka, 1990). The discriminant function, once obtained, can be used to predict the group to which cases with certain characteristics belong. The weights associated with each variable in the discriminant function indicate its relative importance. The higher the weight, the greater the associated variable's importance. Pettway and Sinkey (1980) and Adekanye (1993) used this technique.

Canonical correlation analysis

This method identifies linear combinations of independent variables that are most highly (or canonically) correlated with linear combinations of the dependent variables. The studies that have used this methodology (Fraser et al., 1974; Arshadi and Lawrence, 1987) rely on more than one variable in defining performance. As Hunter and Srinivasan (1990) pointed out, the method precludes the explicit calculation of marginal value of independent variables on the dependent (choice) variable. Nor can the significance of individual explanatory factors be ascertained.

Probit and logit analysis

These methods of analysis are similar, differing essentially in the underlying distributional assumptions. While the probit technique is based on the cumulative normal distribution, the logit technique is based on the cumulative logistic probability function. The essence of the application of these techniques to bank performance is to estimate the chance that a non-sample bank will fall in a performance category given our knowledge of the characteristics of banks in each of the two categories. The probit model has been applied by Korobow, Stuhr and Martin (1976) and Hunter and Srinivasan (1990) while the Logit technique has been used by Martin (1977), Pantallone and Platt (1987) and Adekanye (1993).

Survey approach

This represents a major component of Adekanye's study. Using a questionnaire directed at the management of a sample of Nigerian commercial banks, he was able to identify the factors that were believed to be major determinants of bank performance. These were essentially the components of the CAMEL acronym. In terms of importance, they were ranked as follows: managerial efficiency, asset quality, liquidity, capital adequacy and loan portfolio. The set of financial information rendered by the banks equally subjected to more rigorous analysis using the MDA and logit, and managerial efficiency came out as the most important factor.

Data envelopment analysis (DEA)

Graham and Horner (1988), in a study by the Office of the Comptroller of the Currency in the USA, concluded that the difference between the failed banks and those that remained healthy or recovered from problems was the calibre of management. Developing a reliable quantitative measure to determine the quality of a bank's management has posed difficulties, however.

The DEA is based on the application of economic production theory to the behaviour of a banking firm. This theory regards the bank as using a combination of inputs to produce one or more outputs. Essentially, banks are seen as attracting deposits and incurring interest expenses, salary expenses, premises and fixed assets as well as other non-interest expenses (as inputs) to generate loans and investments/earning assets and total interest income (as outputs). DEA computes a bank's efficiency in transforming inputs into outputs as a good measure of management quality. This efficiency measure of a bank's management quality is relative to the efficiency of its peers within the industry. The technique, based on linear programming, reflects the conversion of multiple inputs into multiple outputs and associates a scalar measure to reflect the efficiency in conversion. The conversion is accomplished by comparing the mix and volume of services provided and the resources used by each bank compared with all other banks.

Siems (1992) applied DEA to assess the significance of management quality in distinguishing surviving from failed banks in the USA. Using a sample of 611 surviving banks and 319 failed banks, he showed that management quality is important for a bank's long-term survival. Yue (1992) applied the same technique to analyse the efficiency of 60 Missouri banks for the period from 1984 to 1990. The methodology provided for the evaluation of the relative efficiency of different banks at the same time and the assessment of inter-temporal changes in the performance of individual banks. Other notable applications of the DEA to banking include Sherman and Gold (1985), Parkan (1987), Rangan el al (1988), Berg et al. (1989), Charnes et al. (1990), Aly et al. (1990), Siems (1991), and Barr and Siems (1991a/b). Barr and Siems (1991b) demonstrate how the DEA efficiency scores can be incorporated as a variable in an early warning model.

A major advantage of DEA that makes it attractive and adequate for developing country research is the minimal data requirement. It requires data only on inputs and outputs,

which are readily available from the annual reports of banks. No price data are required on inputs and outputs. Its limitation, however, is that it is sensitive to changes in the number of banks, inputs and outputs.

This technique is deemed superior to single ratio analyses because the model allows the computation of efficiency by examining management's role in making resource allocation and product decisions. Regulators could use the bank management quality metric to identify the most inefficient banks that require greatest attention. DEA is discussed further below.

III. The methodology

As indicated earlier, this study relies heavily on the DEA approach to measuring relative efficiency among Nigerian banks. The theoretical expositions of Yue (1992) and Siems (1992) provide an excellent concise representation of the DEA methodology that can be easily appreciated and understood.

Siems (1992) explained that DEA identifies the most efficient bank(s) in a population and provides a measure of inefficiency for all others relative to the most efficient bank. The most efficient bank(s) is(are) rated a score of 1 while the relatively less efficient ones are rated between 0 and 1. The technique is designed to measure relative efficiency using multiple inputs and outputs of banks with no a priori information about which particular inputs and outputs are most important in determining efficiency and thus the efficiency score. The relative efficiency of a bank is measured as the ratio of its total weighted output to its total weighted input. The weights used in measuring the weighted output and input, are determined endogenously in the DEA methodology. The weights, which are universal to all banks within the population of interest, represent those that maximize each bank's efficiency score; weights cannot be negative. By universal is meant that any bank should be able to use the same set of weights to evaluate its own efficiency ratio and the resulting ratio must not exceed one. The implication of this procedure is that, for each bank (or decision making unit, DMU), DEA will maximize the ratio of its (the bank's) own weighted output to its own weighted input. In general, higher weights will be associated with those inputs that a bank uses least as well as those outputs that it produces most.

The mathematical representation of the basic DEA model is traceable to Charnes Cooper and Rhodes (1978) and is referred to as the CCR model. If n banks (as DMUs) convert the same m inputs into the same s outputs and the jth bank uses an m-dimensional input vector, X_{ij} (i=1,2,....,m), to produce an s-dimensional output vector, Y_{rj} (r=1,2,...,s), and denoting the bank under evaluation by subscript o, the optimization problem solved for each bank is expressed as:

$$\text{Maximize } h_o = \sum_r U_r Y_{ro} / \sum_i V_i X_{io} \qquad (1)$$

subject to the constraints

$$\sum_r U_r Y_{rj} / \sum_i V_i X_{ij} \leq \quad for\, j=1,2,..,n \qquad (2)$$

$$U_r \geq 0 \quad for\ r=1,2,..,s \tag{3}$$

$$V_i \geq 0 \quad for\ i=1,2,..,m \tag{4}$$

where Ur denote the output weights and Vi denote the input weights and both must be non-negative.

The sum $\sum U_r.Y_{rj}$ is referred to as the virtual (weighted) output and the virtual (weighted) input is defined as $\sum V_i.X_{ij}$. The objective function defined by h_o is the ratio of weighted output to weighted input, which is the relative efficiency ratio. The maximum of the objective function (h_o*) is the DEA efficiency score assigned to bank o and the solution set is a set of optimal input and output weights. The first set of constraints Equation (1) guarantees that the efficiency ratios of other banks (computed by using the same weights U_r and V_i) are not greater than unity. The optimization problem is well defined for every bank since every bank can be bank o. The maximum value h_o can assume is 1. If this efficiency score is 1, bank o satisfies the necessary condition to be DEA efficient; otherwise, it is DEA inefficient. This implies that for any group of banks, one or more must be the most efficient (having efficiency score h_o=1), while others (with efficiency score $h_o < 1$) will be relatively inefficient compared with the efficient ones. Furthermore, the efficiency scores make for a ranking of the banks in the population from the least efficient to the most efficient. While the most efficient bank(s) must (each) have an efficiency score of unity, the least efficient bank need not have a score of zero.

The optimization problem reflected in equations 1 to 4 represents a linear fractional programming problem that is difficult to solve. The non-linear problem, however, can be transformed into a linear problem that is easily solved using the standard simplex algorithms in linear programming. The linear programming equivalent is expressed as:

$$\text{Maximize } Y_o = \sum_r U_r.Y_{ro} \tag{5}$$

subject to the constraints

$$\sum_i V_i.X_{io} = 1 \tag{6}$$

$$\sum_r U_r.Y_{rj} - \sum_i V_i.X_{ij} \leq 0 \quad for\ j=1,2,..,n \tag{7}$$

$$U_r \geq \varepsilon \quad for\ r=1,2,..,s \tag{8}$$

$$V_i \geq \varepsilon \quad for\ i=1,2,..,m \tag{9}$$

where the subscript **o** represents the bank (DMU) being evaluated, X_{ij} denotes input *i*, Y_{rj} denotes output *r* of bank *j*, and U_r and V_i represent the weights for outputs and inputs,

respectively.

The linear programming problem has a dual for which purpose an arbitrary small positive number, E, is introduced to ensure that all of the observed inputs and outputs have positive values (or shadow prices) and that the optimal value of h_o is not affected by the values assigned to the so-called slack variables in the dual problem. The solution to the dual problem provides a framework for assessing the adjustment necessary for each inefficient bank to become efficient. By this we mean the amounts of inputs to be reduced and outputs to be increased to move the bank to the efficiency frontier. The weights in the primal solution provide information on the relative importance of inputs and outputs in the DEA evaluation of the efficiency of the population of banks.

There is no limitation on how many banks can be considered in the DEA model. As mentioned earlier, however, the model scores (or assessment of relative efficiency) can be expected to be sensitive to the number (or population) of banks considered as well as to the number of inputs and outputs. Therefore, a bank may cease to be the most efficient with the introduction of a new bank into the population of banks. A change in the combination of inputs and inputs used in the model may also cause a most efficient bank to become relatively inefficient. The choice of inputs in the literature has largely been informed by the model of the banking firm adopted. Yue's (1992) inputs were just four: interest expenses, non-interest expenses, transaction deposits and non-transaction deposits. The outputs were interest income, non-interest income and total loans. Siem's (1992) also included four inputs: number of full-time equivalent employees, salary expenses, value of premises and fixed assets, and other non-interest expenses. There are two final outputs, earning assets and total interest income. Siems's framework sees deposits as intermediate inputs while Yue's considers them as primary inputs. The literature, however, does not provide a basis for assessing the sensitivity of the DEA methodology to the different models, and perhaps therefore for choosing which is more appropriate. One factor that may help to determine the specific types and number of inputs and outputs appropriate for an application to Nigerian banks is the degree of comprehensiveness and consistency in information reported by banks over the study horizon.

IV. The Nigerian banking sector pre and during sap

The banking sector pre-SAP

The Nigerian banking sector witnessed serious problems that led to mass failure of banks in the early 1950s. The failed banks consisted then of many private initiatives that had adopted over zealous credit expansion policies in an attempt to increase what was observed as restricted access to credit by existing foreign banks. The latter years of the 1960s witnessed the gradual return of normalcy and an attempt to forestall more failures by the introduction of basic regulatory policies to ensure that banks were adequately capitalized and liquid and that they expanded moderately in their credit portfolio. Cash reserve ratios were introduced and so were adjusted capital ratios. Banks operated in a market in which prices were dictated by the regulatory authority. There was little or no need for competition as many banks were very comfortable, with profit positions largely made without effort. The level of capital in retrospect was equally sufficiently low, having little or no bearing to the changing structure of banks' assets and by implication the riskiness of banks' assets. The policy environment was largely stable, with occasional changes in details of specific regulatory ratios and rarely such major policy redirection as was observed with the adoption of SAP and the trial and error approach that has accompanied its implementation. Policy stability enhanced the stability of bank performance also. There were no clear guidelines on identification of weak and low quality assets nor was there any uniform method among banks for making provision for these assets. These of course brought about non-recognition of same by the industry, leading to false profit levels and acutely inadequate capital to serve as cushion in the event assets crystallized.

Some recent developments in the Nigerian banking sector

With the adoption of SAP the regulatory framework guiding the operations of banks changed. Steps were taken to liberalize interest and lending rates. Many more banks were allowed entry into the sector. Competition increased a great deal among banks and the face of the industry changed within a few years. At different times ceilings on interest rates were removed, replaced and then removed again. In 1994, the ceilings and floors on interest rates were again restored. Regulatory authorities took steps to correct some

of the endemic afflictions of banks that were carrying poor quality assets and had little cushion for it. Capital adequacy, liquidity and credit restrictions were enhanced to forestall the possibility of continuous deterioration in the health of the critically affected banks.

Meanwhile, the newer banks developed new products and created various opportunities for exploiting profit. They grew in profits by leaps and bounds, though industry watchers claim the bulk of their profits is accounted for by their undue emphasis on foreign exchange trade and the sharp practices in which they engaged. This coupled with the continued depreciation of the naira since the inception of SFEM has led to a seemingly unending search for the ideal market mechanism for allocating scarce foreign exchange. The new era has also seen an unprecedented level of fiscal indiscipline on the part of government, a recurring feature that has made liquidity management in the sector an uphill task.

The period 1990 to 1992 was an interesting one in our experience of deregulation of the Nigerian economy and the financial system. The year 1990 in particular is noted for the very bold and decisive steps taken by the monetary authorities to monitor and safeguard the quality of assets of the banking industry as well as ensure that the sector was adequately capitalized, thus promoting safety and soundness of the system. It is clear from theory what devastating effects the poor quality of banking system assets and disproportionate exposure coupled with a thin cushion for losses could do to the system. Beyond the erosion of public confidence, which should be enough to put monetary authorities and policy makers on guard, there is the effect of the creation of considerable leakages, which will then undermine the efficacy of monetary policy. To this end, prudential guidelines were introduced that were to be immediately applied by all banks. These policy guidelines specified unambiguous steps that banks should take to recognize and fully provide for their non performing assets. Aside from ensuring that bank profits were real cash profits, it was meant to make for uniformity within the system and meaningful comparison among banks.

Added to the prudential guidelines was the increase in the minimum paid-up capital of commercial banks to ₦50 million from ₦30 million and from ₦20 million for merchant banks to ₦40 million. To complement this capital requirement, the newly prescribed international capital adequacy ratio was adopted. This international capital requirement maintains that the ratio of each bank's adjusted capital to its risk weighted assets be set at a minimum of 8%. A transition period ending in 1991 was allowed, within which banks were required to maintain the ratio at a minimum of 7.25%.

In 1991, ceilings on interest rates were removed for the second time, though a floor was imposed on deposit rates. Banks were allowed to earn a spread of 5% between their average cost of funds and their prime lending rate. Depositors and borrowers were free to negotiate and agree on applicable rates subject to a minimum of 13.5% p.a. on deposit accounts. With the influx of non-bank financial institutions, which have continued since mid 1990, competition drove interest rates very high. The liquidity mop-up exercise of the Apex bank also contributed a great deal to the prevailing rates. Beginning with the last quarter of 1991, credit expansion ceilings were removed with the introduction of the healthy/distressed classification of operating banks by the Apex bank. Only healthy banks, going by the criteria employed by the monetary authorities, used the policy change. Distressed banks still had to obey ceilings that hitherto had been general.

This development coupled with the signs of default that had begun to emerge in the non-bank financial institutions sub sector gingered the consciousness of the public. The classification has thus continued to be used as a yardstick till today by bank customers and the public, though little is known about which banks are actually distressed and which are healthy, except for glaring cases such as National Bank of Nigeria and a few other government-owned banks.

With each passing year, naira devaluation continued under the float mechanism adopted for exchange rate determination. Though the foreign exchange market remained largely liberalized, the rules of allocation changed from time to time. Due to the arbitrage opportunities that remained a permanent feature of the exchange markets, banks have understandably developed an insatiable appetite to participate in the market, which has unwittingly constituted a key source of considerable non-interest income for them. On 5, March 1992, the monetary authorities implemented an 80% depreciation of the naira and have kept the rate largely "fixed" or "stable" ever since. The market has nevertheless remained a source of non-interest income for banks.

The crises of non-repayment of depositors' funds at maturity and inter-finance house placements affected on the inter-bank money market. Since the closing months of 1992, activity in the market has gradually reduced and was at a standstill over the greater part of 1993. Essentially, signs of distress in the system had begun to appear in 1992.

Finally, more visible efforts were made to privatize all the 12 wholly owned federal government banks. The sales did not, however, hit the market until 1993. Some of the state-owned banks also attracted great attention from the regulatory and supervisory authorities due to their deteriorating state of ill-health.

V. Empirical analysis of bank performance and efficiency: 1983-1993

Sample selection and characteristics

The sample comprises mainly Nigerian commercial banks that operated at any time within the 11- year study period covering 1983 to 1993. The sample comprises 20 banks in each of the years prior to SAP and about 35 since SAP. The choice of banks was largely informed by the availability of data and the need to base our analysis, as much as possible, on a consistent and uniform sample. To enhance intertemporal comparison of efficiency of each bank and across banks, we pooled the entire sample of banks over the period. In this regard, we may therefore view the sample for the study horizon as consisting of a total of 278 commercial banks. We have limited the scope of the study by focusing only on commercial banks, thus excluding merchant banks, in view of the significant differences in the regulatory requirements guiding their operations. For example, merchant banks are expected to hold a greater proportion of longer-term assets than commercial banks. The implications for pricing and earnings would therefore be different across the categories of banks. In addition, their funding base is necessarily constrained by the limitation imposed on them regarding branching and minimum account opening balance. Merchant banks tend to have much higher average deposit costs than commercial banks. These factors by their very implications suggest that comparison between the two categories of banks would not be meaningful.

The sample of banks comprises old and new banks, private and government-owned banks, and they vary in size and capital adequacy. Private banks are defined as those without any government equity participation or that are newly privatized. There are federal government banks and state government banks. The former group are those in which the federal government has more than 25% in equity and the state banks are those in which one or more states account for more than 25% of the equity. Reference to government owned banks in this study implies the collection of federal and state government banks. As can be observed from Table 1, private sector participation in the banking sector has been on the increase. In 1983, 85% of operating commercial banks were either federal or state government controlled and only 15% featured substantial private sector involvement. Since the adoption of SAP, the proportion of private banks has been on the increase. In 1987, government controlled banks had declined in proportion to 75%. By 1993, of the sample banks, 18% were federal government controlled compared with 82% controlled by the private sector. This is of course consistent with entry liberalization into the sector brought about by the SAP.

Table 1: Distribution of sample banks by selected characteristics (%)

	Capital adequacy		Profitability		Asset size		Ownership	
Year	< 5%	>= 5%	< 2%	>= 2%	< ₦500m	>= ₦500m	Private	Govt.
1983	60	40	80	20	50	50	15	85
1984	60	40	87	13	52	48	22	78
1985	65	35	82	18	52	48	22	78
1986	54	46	71	29	50	50	25	75
1987	52	48	80	20	36	64	24	76
1988	50	50	67	33	17	83	25	75
1989	32	68	52	47	38	62	32	68
1990	20	80	45	55	45	55	50	50
1991	25	74	48	52	18	81	52	48
1992	17	83	33	67	7	93	60	40
1993	17	82	29	71	4	96	82	18

Some characteristics of Nigerian commercial banks: 1983-1993

The structural adjustment programme (SAP) was adopted in July 1986. We therefore refer to the period 1983 to 1986 as the pre-SAP period and 1987 to 1993 as the SAP period. The return on assets (ROA) of Nigerian commercial banks averaged 1.15% over the pre-SAP period compared with 2.36% during SAP. Table 2 confirms that there has been a significant jump in the profitability of banks during the era of SAP. From Table 3 we observe a somewhat stable level of profitability between 1983 and 1985. From an ROA of 1.05% in 1985, a jump to 1.56% was recorded in 1986 and this trend appears to have been maintained. The very recent years of 1992 and 1993 with ROA of 3.14% and 4.21% respectively, show particularly impressive industry profitability.

The average cost of deposits also distinguishes banks between pre-SAP and SAP periods. An average cost of 4.07% was recorded for banks before SAP compared with 9.76% over the SAP period. This is not surprising when it is borne in mind that the deregulation of interest rates was first implemented in 1987. The policy was rescinded after that year and later reintroduced in 1991. We see from Table 3 a consistent increase

Table 2: Results of t-test of differences in selected financial ratios pre and during SAP

S/N.	Financial ratios	1983-1993	Pre-SAP	SAP
1.	Return on asset[1]	1.96	1.15	2.36
2.	Return on equity	23.56	16.86	42.76
3.	Avg. cost of deposit[1]	7.92	4.07	9.76
4.	Loan to asset[1]	31.02	40.93	26.29
5.	L.loss provision/ total loans[1]	5.35	2.28	6.80
6.	Capital to asset	6.32	5.78	6.57
7.	Capital to loan[3]	32.18	24.68	35.76
8.	Loan to deposit[1]	43.68	53.64	38.92
9.	Liquid asset to total asset[1]	51.91	44.51	55.45
10.	Op. expense/operating income	78.86	82.66	77.04
11.	Op. expense/total asset [1]	6.05	4.29	6.89
12.	Fixed asset/total asset[1]	3.74	2.64	4.27
13.	Earning asset/total asset[1]	84.91	87.52	83.65
14.	Capital to earning assets[2]	7.56	6.77	7.95
15.	Gross earnings/earning assets[1]	15.99	9.71	19.02
16.	Gross earnings/total assets[1]	13.32	8.47	15.64
17.	Fixed asset/capital	72.52	64.94	76.16
18.	Return on earning assets[1]	2.36	1.32	2.85

Ratios are presented in percentages (%).
1 signifies that the ratio has significantly different means between the pre-SAP and SAP periods.

in average funding cost from 1987 to 1990. The trend has remained after a temporary drop between 1990 and 1991.

The asset structure of commercial banks have also changed significantly since the introduction of SAP. As a proportion of total assets, loans and advances have reduced markedly from an average of 40.9% pre-SAP to 26.3% during the SAP period. Cash and short-term funds as a proportion of total assets have increased from an average of 44.5% pre-SAP to 55.5% during the SAP era. Loans have equally reduced significantly as a

Table 3: Means of selected financial ratios - 1983 to 1993

S/N	Financial ratios	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1.	Return on asset	1.07	0.90	1.05	1.56	1.59	1.79	1.54	2.16	1.96	3.14	4.21
2.	Return on equity	14.05	8.47	13.83	30.12	24.44	23.47	-357.50	10.83	20.87	29.86	45.18
3.	Avg. cost of deposit	3.58	3.86	4.10	4.66	5.60	7.11	8.11	10.73	9.26	12.03	15.10
4.	Loan to asset	43.39	39.46	39.76	41.39	34.60	35.97	29.81	21.92	19.57	22.36	20.11
5.	L.loss provision/ total loans	4.42	1.45	1.87	1.69	2.51	3.76	6.58	6.58	8.59	6.81	12.02
6.	Capital to asset	6.20	6.69	5.37	4.98	4.47	4.53	6.65	7.82	6.51	8.16	7.54
7.	Capital to loan	38.88	31.45	16.70	14.03	44.57	16.15	29.54	40.85	39.10	39.61	41.31
8.	Loan to deposit	53.24	51.55	51.96	57.59	48.11	47.82	43.00	33.24	29.96	36.95	32.93
9.	Liquid asset to total asset	43.72	46.27	46.03	42.03	49.10	49.51	61.78	61.91	61.91	60.86	62.52
10.	Op. expense/ operating income	87.16	90.90	81.26	72.36	75.12	75.17	86.41	8.35	80.20	72.14	70.26
11.	Op. expense/ total asset	4.90	3.93	4.41	4.01	4.18	4.86	7.64	7.36	7.04	7.24	9.23
12.	Fixed asset/ total asset	2.56	2.85	2.62	2.51	2.65	2.79	4.25	4.72	4.73	5.09	5.39
13.	Earning asset/ total asset	8.83	7.66	8.59	8.81	9.67	11.95	14.76	16.58	15.16	17.62	22.87
14.	Capital to earning assets	59.54	63.11	66.32	69.87	83.67	78.09	54.40	76.93	91.83	76.34	77.65
15.	Gross earnings/ earning assets	86.79	88.31	89.05	85.91	87.49	83.47	83.17	84.03	81.72	83.49	82.71
16.	Gross earnings/ total assets	7.62	7.75	6.03	5.80	5.13	5.50	8.33	9.15	7.91	9.82	9.29
17.	Fixed asset/capital total assets	10.14	8.65	9.67	10.38	11.21	14.40	18.09	19.93	18.69	21.28	28.24
18.	Return on earning assets	1.11	1.02	1.19	1.89	1.91	2.22	2.35	2.39	2.25	3.65	4.90

ratio of deposits from 53.6% pre-SAP to 38.9% during SAP. Commercial banks' fixed assets as a proportion of total assets has increased significantly from 2.64% to 4.27%. We deduce from this trend that as measures of liquidity, loan to asset, loan to deposit and the liquid asset ratios suggest significant shifts in asset structure and indeed, in liquidity. Banks have become more liquid with deregulation, though an average higher but affordable proportion of their total assets is now accounted for by fixed assets. Many of the new entrants are known to have acquired fixed assets especially in a bid to remain technologically relevant in the increasingly competitive environment. While this trend is understandable, what appears worrisome is the fact that as a proportion of bank's capital, fixed assets averaged 76.2% during the SAP era compared with about 65% over the pre-SAP era. This fear is further corroborated by the significant decline in the proportion of banks' earning assets from 87.5% pre-SAP to 83.7% in the SAP era.

Whereas the assets of banks in nominal terms have grown significantly over time, the shift in structure away from the traditional loans toward liquid assets has been accompanied by a significant jump in loan loss provision as a ratio of total loans. The ratio jumped from an average of 2.3% pre-SAP to 6.8% during SAP as can be seen from Table 2. A number of regulatory prescriptions have informed the increase in capital to loan and capital to asset ratio. The former has increased to 35.8% during SAP from 24.7% pre-SAP while the latter has increased to 6.6% during the SAP from 5.8% pre-SAP. The minimum authorized and fully paid-up share capital of commercial banks has been increased twice since the SAP period.

Size characteristics

For the purpose of isolating the relationship between a bank's size and its efficiency we categorized banks into two groups on the basis of their asset size. In the literature, asset and/or deposit base of banks have been adopted as proxy for their size. At times their market share of assets and/or deposit have also been used. The second set of measures, however, follows from the first. One set of banks have asset size below ₦500 million while the other size post at least a balance sheet figure of ₦500 million in assets. The choice is informed by the need to avoid a concentration of banks in any period since to a large extent the large and growing sizes of banks have been accelerated by the naira depreciation and high and rising inflation rate since SAP.

From Table 4, it is clear that the classification adopted significantly distinguishes at 5% level banks with assets below ₦500 million from those that are larger. Indeed, of the 278 banks in the sample, 89 had assets below ₦500 million and 189 posted balance sheet figures in excess of this amount. The profitability of the bigger banks is also significantly higher than that of the smaller banks when their ROAs of 2.2% and 1.5%, respectively, are compared. The average funding cost of bigger banks is higher at 8.7% than that of smaller banks at 6.3%. The average funding cost differs between the categories of banks as exemplified by the statistical significance of this variable at 5% level. Bigger banks also have higher loan loss proportions at 6.5% compared with only 3.0% on the average for smaller banks. By way of asset structure, however, both categories of banks would

Table 4: Bank size - results of t-test of differences in selected financial ratios pre and during SAP

S/N	Fincial ratios	Pre-SAP		SAP		< ₦500 m	>₦500m
		< ₦500m	> ₦500m	< ₦500 m	> ₦500m		
1.	No. of Banks	46	44	43	145	89	189
2.	Asset	241.9	2001.8[1]	328.0	3557.7[1]	283.5	3195.5[1]
3.	Deposit	183.6	1616.1[2]	221.5	2271.5[1]	209.5	2118.9[1]
4.	Return on Asset	0.7	1.6[1]	2.2	2.4[1]	1.5	2.2[1]
5.	REturn on Equity	14.8	19.0	22.0	-16.9	18.2	-43.1
6.	Avg. cost of Deposit	3.7	4.4[1]	9.0	10.0[1]	6.3	8.7[1]
7.	Loan-to-Asset	39.5	42.4[1]	25.3	26.6[1]	32.7	30.3
8.	L.Loss Provision Total Loans	1.2	3.4[1]	4.8	7.4[1]	3.0	6.5[1]
9.	Capital-to-Asset	7.1	4.4[1]	8.2	6.1[1]	7.7	5.7[1]
10.	Capital-to-Loan	34.6	14.3	56.2	29.7[1]	45.1	26.1[2]
11.	Loan-to-Deposit	52.7	54.6[1]	39.1	38.9[1]	46.1	42.5
12.	Liquid Asset-to-Total Asset	47.2	41.6[1]	58.9	54.4[1]	52.9	51.4
13.	Op.Expense/ Operating Income	91.6	73.3	73.2	78.2	82.7	77.1
14.	Op.Expense/ Total Asset	4.2	4.3[1]	5.9	7.2[1]	5.1	6.5[1]
15.	Fixed Asset/ Total Asset	2.8	2.4[1]	4.2	4.3[1]	3.5	3.8
16.	Earning Asset/ Total asset	7.8	9.2[1]	14.2	16.5[1]	10.9	14.4[1]
17.	Capital -to-Earning Assets	53.4	76.9	50.0	84.0	51.8	82.3[1]
18.	Gross Earnings/ Earning Assets	87.5	87.6	85.1	83.2	86.3	84.2[2]
19.	Gross Earnings/ Total Assets	8.4	5.0	9.8	7.4	9.1	6.8[1]
20.	Fixed Asset/ Capital	8.9	10.5	17.1	19.6	12.9	17.5[1]
21.	Return on Earning Assets	0.8	1.8[1]	2.7	2.9[1]	1.7	2.7[1]

appear to have similar structures going by the loan to asset and liquid asset ratios that show no statistical significance. With respect to capital adequacy, the statistical significance of capital to asset and capital to loan ratios respectively suggests that smaller banks are better capitalized than bigger banks. Whereas the capital to loan ratio for smaller banks averaged 45.1%, for bigger banks it averaged 26.1%.

Bank profitability

It is widely accepted that a profitable bank is one whose ROA is at least 2% while less profitable ones are those with lower ROA. Some studies have also assumed a benchmark of 1.5%. We have categorized bank profitability on the basis of a 2% ROA. We find from our sample that this benchmark distinguishes banks by profitability. For example, Table 5 confirms the significance of ROA at 5% level. Deposit size differs significantly at 10% level between profitable and less profitable banks as can also be observed from Table 5. Indeed, from this conclusion it can be seen that less profitable banks have higher average deposit levels than profitable ones. Other factors that distinguish profitable from less profitable banks include average funding cost, which is higher for profitable banks, asset structure, asset quality, capital adequacy and managerial efficiency. On asset structure, we observe a statistically significant difference in the loan to asset and loan to deposit ratios between the two classes of banks. The more profitable banks have a lower proportion of loans on the average at 24% when compared with less profitable banks at 35.8%. Also, as a proportion of deposit, loans averaged 48.5% for less profitable banks when compared with 36.5% for profitable ones. In respect of asset quality, as expected, less profitable banks have a significantly higher loan loss proportion when compared with profitable banks.

Popular ratio analyses used to assess managerial/management efficiency include the ratios of operating expense to operating income and operating expense to total assets, among others. Our comparative analysis reveals that operating expense to operating income ratio for less profitable banks is significantly higher than that for profitable banks. For every naira income, less profitable banks expend 94.1 kobo on the average while profitable ones spend an averagge of only 56.2 kobo.

Finally, from the statistical significance at 5% level of the capital to loan and capital to asset ratios, we confirm that profitable banks have a greater capital cushion for loan losses and assets.

Bank capitalization

Table 6 also confirms our conclusion on the higher capital cushion offered by more profitable banks in that banks with capital to asset ratios in excess of 5% are more profitable than those with lower ratios. Average funding cost, at 8.7%, is significantly higher for banks with capital ratios in excess of 5%, compared with 6.8% for banks with lower capital ratios. Significant differences exist between the asset structures of these sets of banks. The average ratio of loan to deposit and loan to asset is in both cases significantly

Table 5: Bank profitability: Results of t-tests of differences in selected financial ratios pre and during SAP

S/N	Financial ratios	Pre-SAP		SAP		ROA <2%	ROA >= 2%
		ROA < 2%	ROA >= 2%	ROA <2	ROA > 2%		
1.	No. of banks	72	18	94	94	116	112
2.	Asset	1087.4	1162.1[1]	3654.7	1983.2[2]	2541.2	1851.2[3]
3.	Deposit	864.3	962.5[1]	2356.9	1248.2	1709.5	1202.3[2]
4.	Return on asset	0.7	3.0	0.3	4.3[1]	0.5	4.2[1]
5.	Return on equity	12.1	36.0	-128.5	43.0	-67.6	41.9
6.	Avg. cost of deposit	4.2	3.5[1]	7.9	11.6[1]	6.3	10.3[1]
7.	Loan to asset	42.8	33.6[1]	30.5	22.1[1]	35.8	24.0[1]
8.	L.loss provision/ total loans	2.3	2.1[1]	8.9	4.8[1]	6.0	4.3[2]
9.	Capital to asset	5.6	6.5	5.4	7.7	5.5	7.5
10.	Capital to loan	22.3	34.1	31.0	41.3	26.8	40.2
11.	Loan to deposit	56.3	43.1[1]	42.6	35.3[2]	48.5	36.5[1]
12.	Liquid asset to total asset	43.0	50.6[1]	51.1	59.8[2]	47.6	58.3
13.	Op. expense/ operating income	94.0	37.2	94.2	59.9	94.1	56.2[1]
14.	Op. expense total asset	4.6	3.2[1]	7.4	6.4[1]	6.2	5.9
15.	Fixed asset/ total asset	2.7	2.2[1]	4.2	4.3[1]	3.6	4.0
16.	Earning asset/ total asset	8.3	9.0[1]	13.2	18.0[1]	11.1	16.6[1]
17.	Capital to earning assets	6.5	7.7	6.7	9.2	6.6	9.0[1]
18.	Gross earnings/ earning assets	9.5	10.4[1]	16.5	21.5[1]	13.5	19.7[1]
19.	Gross earnings/ total assets	87.6	87.4[1]	82.5	84.8	84.7	85.2
20.	Fixed asset/capital	73.0	32.6[3]	93.5	59.1[1]	84.5	54.5
21.	Return on earning assets	0.8	3.6	0.5	5.1[1]	0.6	5.9[1]

1 signifies that the means of the ratio significantly differ at 5% between profitability classes.
2 signifies that the means of the ratio significantly differ at 10% between profitability classes.

higher for less capitalized banks than for well capitalized ones. This observation, compared with the significantly higher ratio of cash and short-term assets to total assets for banks with capital ratios in excess of the 5% benchmark, indicates that banks in this group are more liquid on average than banks in the other group. As with efficiency, banks with

Table 6: Capitalisation: Results of t-test of differences in selected financial ratios pre and during SAP

S/N. Financial Ratios	<50%		>50%		Capital Ratio	
	Pre-SAP	SAP	Pre-Sap	SAP	<5%	>5%
1. Return on asset	1.2%	0.5%	1.1%	3.1%	0.87%	0.6%
2. Return on equity	21.91%	204.7%	9.3%	27.7%	94.46%	23.7%
3. Avg. cost of Depost	4.5%	9.0%	3.4%	10.1%	6.8%	8.7%
4. Loan to asset	39.0%	29.3%	43.8%	24.9%	34.1%	29.0%
5. L.Loss provision total loans	2.9%	8.2%	1.3%	6.2%	5.6%	5.2%
6. Capital to asset	3.5%	3.0%	9.2%	8.1%	3.2%	8.4%
7. Caital to loan	12.9%	15.9%	42.4%	44.4%	14.4%	43.9%
8. Loan to deposit	52.8%	41.6%	54.9%	37.8%	47.0%	41.5%
9. Liquid asset to total asset	42.9%	49.8%	46.9%	57.9%	46.4%	55.5%
10. Op.expense/ operating income	77.5%	92.4%	90.4%	70.4%	85.2%	74.7%
11. Op.expense/ total asset	4.7%	6.9%	4.4%	6.9%	5.6%	6.4%
12. Fixed asset/ total asset	2.4%	3.6%	3.1%	4.6%	3.0%	4.3%
13. Earning asset/ total asset	8.6%	13.4%	8.2%	16.5%	11.1%	14.8%
14. Capital-to-earning assets	83.1%	116.4%	37.7%	59.0%	100.0%	54.3%
15. Gross earnings/ earning assets	87.2%	81.2%	88.1%	84.7%	84.1%	85.4%
16. Grossearnings/ total assets	4.1%	3.8%	10.8%	9.7%	3.9%	10.0%
17. Fixed asset/ capital	9.9%	17.0%	9.3%	19.9%	13.6%	17.6%
18. Return on earning assets	1.4%	0.9%	1.2%	3.7%	1.1%	3.2%

higher capital ratios are more managerially efficient going by the significance of the operating expense to operating income and operating expense to total assets ratios.

Ownership characteristics

We earlier distinguished between private and government banks. This distinction provides for an interesting investigation into the widely held belief that private banks are usually more efficient than government banks and also that by adopting a market driven economy and simultaneously divesting government equity in the sector, the efficiency of the banks can be enhanced and by implication that of the entire sector. From Table 7, profitability, average funding cost, loan to asset ratio, capital to loan ratio and loan to deposit ratio differ significantly between private and public banks. These banks do not differ in size.

Not surprisingly, private banks are observed to be significantly more profitable than government banks. While the ROA for private banks averaged 3.3%, that for government banks averaged 1.1%. Private banks have a higher average funding cost at 10.5% than do government banks, which averaged only 6.3%. This may not be unconnected with the age advantage of the majority of government banks as well as the privilege enjoyed at least until 1989 when patronage of government owned banks by government parastatals was virtually mandatory and the banks' access to cheap and stable funds was greatly enhanced. Even the states and their parastatals till this day patronize banks in which they have reasonable levels of equity.

Private banks appear to be better capitalized than public banks. The age factor may also be responsible for this. Prior to SAP, the capital position of existing banks, most of which were government owned, was very low. This persisted until the early years of SAP after which they were also mandated by the introduction of the prudential guidelines to make huge provisions for the suspect quality of assets they carried. The newer private banks on their part had relatively cleaner asset portfolios at the time the prudential guidelines were introduced in addition to the fact that for most, within the first few years of entry into the sector, they were expected to enhance significantly their capital positions more than twice.

The significantly higher values of the loan to asset and loan to deposit ratios for government banks reveal that private banks are more liquid and that the asset structures of the categories of banks are different.

Table 7: Bank ownership - Results of t-tests of differences in selected fiancial ratios pre and during SAP

Financial Ratios	Private		Federal Govt		State Govt		Ownership	
	Pre-SAP	SAP	Pre-SAP	SAP	Pre-SAP	SAP	Private	Public Fed & St
No. of banks	19	88	28	32	43	68	107	171
Asset	637.2	2820.7	2376.7	6560.6[1]	478.0	1060.6	2432.9	21.56.9
Deposit	478.1	1666.9	1926.7	4329.9[1]	384.2	759.2[1]	1455	1536.1
Return on asset	1.5%	3.7%	1.8%	1.1%	0.6%	1.2%	3.4%	1.1%
Return of equity	24.8%	40.0%	20.5%	9.2%[1]	11.0%	174%	37.3%	61.5%
Avg. cost of deposit	4.3%	11.8%	4.5%	7.0%	3.7%	8.4%	10.5%	6.3%
Loan-to-asset	28.1%	21.8%	38.8%	29.4%	48.0%	30.7%	22.9%	36.1%
L.Loss provision/ total loans	4.8%	6.3%	2.3%	8.2%[1]	1.2%	6.8%[1]	6.1%	4.9%
Capital-tro-asset	4.6%	7.2%	4.9%	5.2%	6.8%	6.4%	38.5%	28.2%
Capital-to loan	31.1%	40.2%	13.2%	19.4%[1]	29.4%	37.8%	35.7%	48.70%
Loan-to-deposit	40.8%	34.6%	50.9%	40.0%[1]	61.1%	44.0%[1]	38.5%	28.2%
Liquid asset-to-total asset	50.9%	59.6%	50.9%	51.1%	37.5%	52.1%[1]	35.7%	48.7%
Op. expense/ operating income	93.9%	65.9%	69.4%	85.3%[1]	86.3%	87.6%	6.0%	6.0%
Op. expense/ yotal asset	3.1%	6.7%%	4.1%	6.8%[1]	4.9%	7.2%	3.6%	3.8%
Fixed asset total asset	1.2%	4.1%	2.1%	4.0%[1]	3.6%	4.6%	16.0%	11.7%
Earning asset/ total	7.6%	17.8%	9.1%	12.9%[1]	8.4%	14.2%[1]	58.9%	81.1%
Capital-to-earning assets	31.8%	64.8%	40.8%	88.6%[1]	95.3%	85.4%	7.9%	7.3%
Gross earnings/ earning assets	90.9%	84.5%	86.8%	82.1%	86.5%	83.3%	7.9%	7.3%
Gross earnings/ total assets	5.1%	8.5%	5.8%	6.3%	81.5%	8.0%	19.1%	14.1%
Fixed asset Capital	8.5%	21.4%	10.5%	16.0%	9.7%	17.4[1]	3.85	1.4%
Return on earning assets	1.7%	4.3%	2.1%	1.2%[1]	0.7%	1.7%	3.8%	1.4%

VI. Data envelopment analysis of the efficiency of Nigerian banks

The methodology of DEA was detailed in Section III. The methodology based on the input-output concept identifies within a population the most efficient banks and for every bank provides a measure of the relative inefficiency. The efficiency score is a figure on the scale (0,1). The closer a bank's score is to 1, the greater its efficiency relative to others.

As mentioned earlier we selected a total of 278 banks for comparison over a study period of 11 years. It can be safely assumed that they all, being commercial banks, have the same objective function and similar structural characteristics and are subject to the same regulatory and supervisory guidelines.

In view of the problems of data collection associated with obtaining information on such variables as number of staff and staff costs, especially for the early years of the study horizon, we have had to settle for proxies. Our choice of inputs and outputs has also been influenced by the observations made from and comments received on our preliminary analysis. We believe that these have helped a great deal in making the model more suitable for assessing the efficiency of banks over time. Gross earnings and earning assets[3] are selected as the two outputs[4] of the typical Nigerian commercial bank, while the inputs are total deposits, interest paid on deposits, total capital and overhead expenses. Overhead expenses is selected as a proxy for number of staff and staff cost. Overhead expenses comprise staff cost, depreciation and other administrative costs. We also determine that interest paid on deposits could be used as a proxy for total deposits. These choices of inputs reflect not only the data situation in the Nigerian banking sector but also the relative underdevelopment of the sector compared with those of developed countries.

These outputs and inputs were used within the context of the DEA model framework to obtain the relative efficiency of each bank for each of the years in the period covered. In view of the acclaimed sensitivity of the DEA model to inclusion or removal of banks from the sample and also the choice of inputs and outputs, we used five models that differ to some extent in their choice of inputs and outputs. Table 8 gives the combination of inputs and outputs for each model. Each model, however, was based on the same sample size.

The results of the different models are expected to provide insight into the behaviour of the DEA efficiency scores so as to guide the selection of the more appropriate and reliable models as well as examine the resulting trends in intertemporal efficiency. We expected that while the efficiency measures on the (0, 1) scale may differ from model to model, the trend over time, over banks and over models may in fact be the same or

Table 8: Input and output choices for five DEA models

Model	Inputs	Outputs
1	Total deposit, interest expense, Total capital, overhead expense	Gross earnings, earning assets
2	Interest expense, total capital, overhead expense	Gross earnings, earning assets
3	Interest expense, total capital, overhead expense	Gross earnings
4	Interest expense, overhead expense	Gross earnings, earning assets
5	Total deposit, interest expense, overhead expenses	Gross earnings, earning assets

similar. Where this is the case, it will make for a fundamental assessment of relative efficiency in the industry and for selected banks over the study horizon. The results are examined in the next section.

Efficiency measures and trends in the Nigerian banking industry

The average measures (scores) of technical efficiency are given in Table 9 for each year of the study horizon under each of the different models. These measures are obtained by averaging across all banks in each year. Table 9 serves a dual purpose in that it conveys results of significant tests (t-test) for differences in average efficiency of the banking sector between two consecutive periods within the study horizon. These periods are stated under the YEAR column with the corresponding average efficiency measures for the two periods stated side by side under each model. The superscript associated with the measures for the subsequent periods indicates the significance of the difference in average efficiency between the periods under comparison. The notes beneath the table explain further the implications of the superscripts.

The average efficiency measures are depicted in Figure 1, which reveals the trend in commercial bank efficiency over the years in Nigeria. We find from the figure a somewhat stable level of efficiency among banks in the sector between 1983 and 1986. A major upward surge in industry efficiency can be observed between 1986 and 1987, presumably when the first impact of the economy-wide deregulation was felt within the industry. We recall that explicit policies incorporated in the budget of 1987, the first full year of the SAP, touched on the industry's activities directly. During the five-year period 1987 to 1991, industry efficiency assumed a steady decline only to resume its first consistent upward trend since SAP from 1991.

Figure 1: Efficiency trend in the Nigerian banking sector: 1983-1993

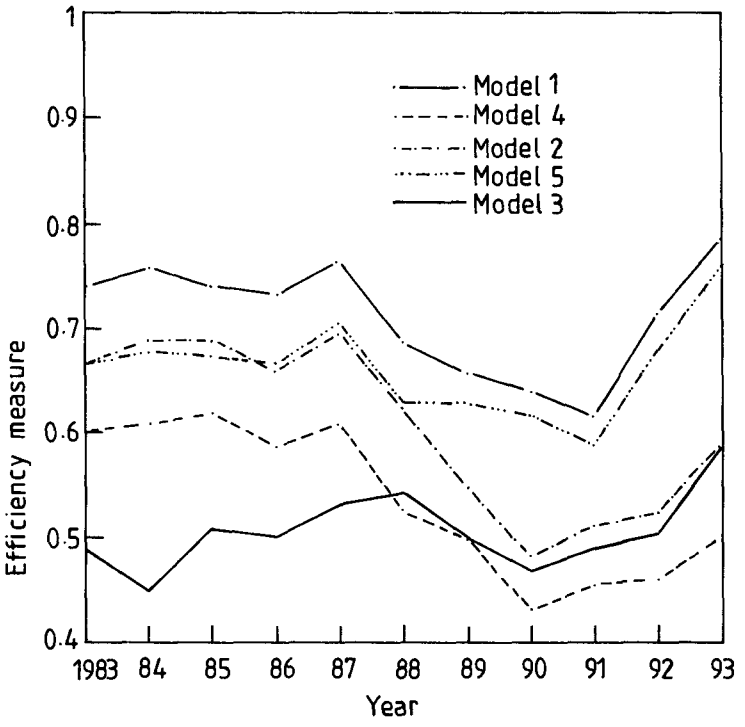


Table 9: Results of t-tests of differences in efficiency for consecutive periods and models

YEAR	Eff. Score 1		Eff. Score 2		Eff. Score 3		Eff. Score 4		Eff. Score 5	
1983/84	0.740	0.758	0.667	0.689	0.489	0.448	0.603	0.608	0.666	0.678
1984/85	0.758	0.741	0.689	0.689	0.449	0.508[3]	0.609	0.619	0.678	0.674
1985/86	0.741	0.733	0.689	0.659	0.507	0.500	0.619	0.586	0.674	0.666
1986/87	0.733	0.765	0.659	0.696	0.500	0.531	0.586	0.609	0.666	0.705
1987/88	0.765	0.687[1]	0.696	0.623[1]	0.531	0.542	0.609	0.525[1]	0.706	0.603
1988/89	0.687	0.657	0.623	0.547[1]	0.542	0.499[2]	0.525	0.497	0.630	0.629
1989/90	0.657	0.640	0.547	0.481[1]	0.499	0.467[2]	0.497	0.431[1]	0.629	0.618
1990/91	0.640	0.616	0.481	0.511	0.467	0.489	0.431	0.455	0.618	0.588
1991/92	0.616	0.715[1]	0.571	0.523	0.489	0.503	0.455	0.459	0.588	0.679[1]
1992/93	0.715	0.787[1]	0.523	0.589[1]	0.503	0.584[1]	0.459	0.500	0.679	0.760[1]

1 signifies that average efficiency measure significantly differs between the corresponding periods.

It is interesting to observe the obvious trends from each of the five different models. The trends for models 1, 2, 4 and 5 are particularly similar. This may not be surprising given that our model specifications make it clear that model 4 is embedded in model 5, and model 2 is embedded in model 1. Model 3, we recall, is the only one in which gross earnings and a flow measure served as the singular output of banks. The trend, though different, is not particularly out of place. We can infer from the common trend across models and in view of the efficiency values that though the measures of efficiency may vary in magnitude with model, to the extent that the trend is same across models, changes in the magnitude of efficiency measures resulting from varying choices of model inputs and outputs may not necessarily make the model irrelevant and inapplicable. By this we are suggesting that if Bank A's efficiency measure is 0.89 and Bank B's is 0.75 under model A, the same conclusions about the industry could be drawn from model B which associates with Bank A an efficiency score of 0.55 and Bank B, an efficiency score of 0.42. Model 1's measures of efficiency are highest in magnitude followed by model 5, model 2, and model 4; and the lowest set of efficiency figures is from model 3. Again, the magnitudes are of little relevance once the trend is common.

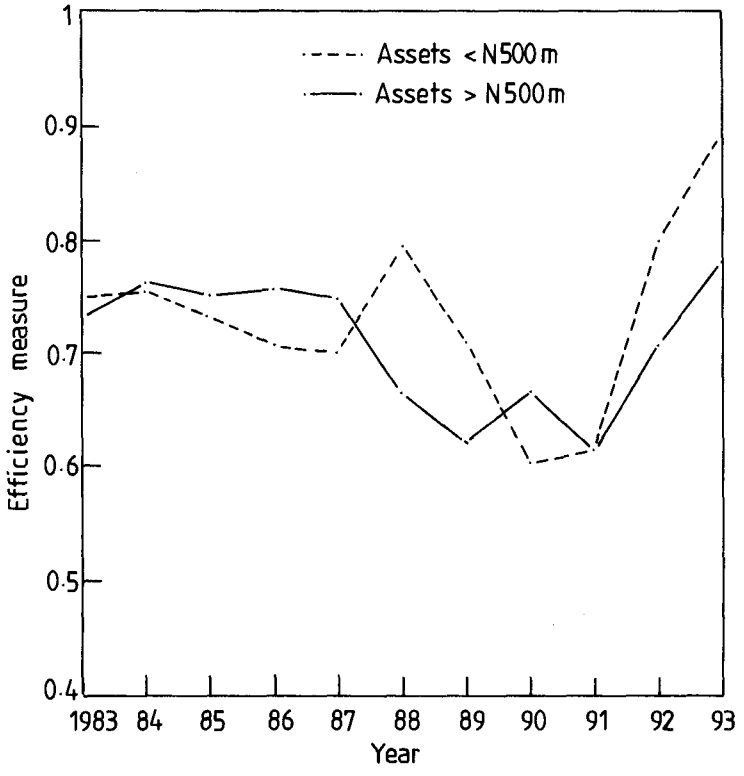
From Table 9 we confirm the significant decline in industry efficiency between 1987 and 1988. All models except model 3 capture this development, though in model 5 it is at a 10% level of significance. Models 1, 2, 3 and 5 capture the upward surge in industry efficiency between 1992 and 1993. Models 1 and 2 suggest significant increase in industry efficiency earlier, between 1992 and 1993. Table 10 shows the results of statistical tests of differences in average industry efficiency before and during SAP. The graphical trend showed stable efficiency pre-SAP and a decline for five out of eight years of SAP. We find for each of the models except Model 5 that industry efficiency prior to the implementation of SAP was significantly different at 5% level from industry efficiency during SAP. Indeed, what we observe is a confirmed reduction in industry efficiency. It must be noted that though model 5 did not establish a significant downward decline during SAP compared with prior to the programme, the year by year significant tests shown in Table 9 indicate a significant decline at the advent of SAP between 1987 and 1988 and significant gains in efficiency in the last two years of the programme, a conclusion similar to that of at least three of the other models.

Table 10: Results of t-test of differences in banking industry efficiency pre and during SAP

S/ N	Efficiency measure	1983-1993	Pre-SAP	SAP
1.	Measure 1[1]	0.712	0.743	0.696
2.	Measure 2[1]	0.603	0.677	0.567
3.	Measure 3[1]	0.507	0.486	0.517
4.	Measure 4[1]	0.531	0.604	0.496
5.	Measure 5	0.664	0.671	0.660
	No. of Banks	278	90	188

The superscript 1 indicates the statistical significance of average efficiency measures between Pre-SAP and SAP periods.

Figure 2: Bank size and efficiency in the Nigerian banking sector: 1983-1993



Size, capitalization, profitability, ownership and industry efficiency in the Nigerian commercial banking sector

The characteristics of Nigerian commercial banks were examined in Section IV. For a further exposé on industry efficiency, we sought to examine the relationship if any between industry efficiency and some industry characteristics such as size, capital adequacy, profitability and ownership.

Bank size and efficiency

It seems clear from the results of the statistical test of differences in average efficiency between banks with assets of at most ₦500 million and those with balance sheet figures in excess of ₦500million. Significant differences were confirmed by tests based on the efficiency scores of models 3, 4 and 5. The proven cases of statistical significance did not make for consistent conclusions, however. In two of the three cases average efficiency of smaller banks exceeded that of the bigger banks (Table 10). Over the study period, a plot as in Figure 2 of average efficiency measures under model 1 illustrates the difficulty in concluding that bank size has anything to do with efficiency. In some years, smaller

banks have been more efficient and in other years bigger banks have been more efficient.

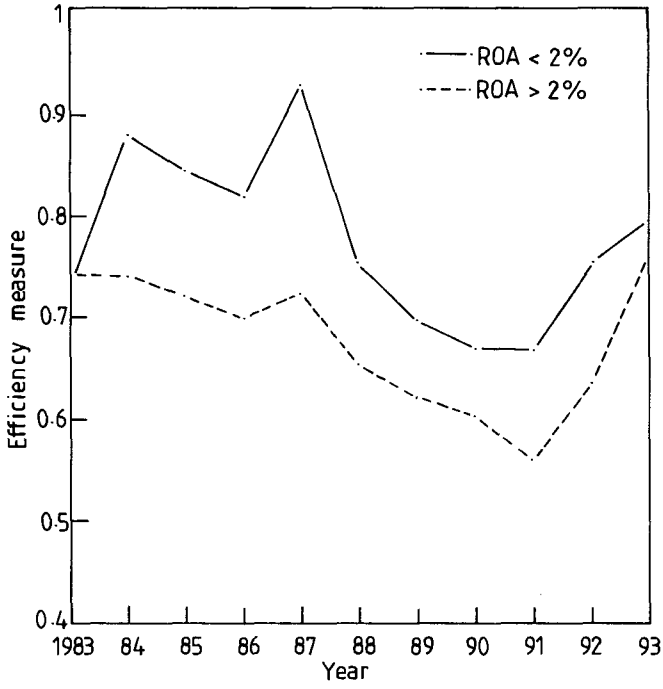
Table 11 shows the results of a statistical comparison of the average efficiency of each group of banks pre and during SAP. Models 2, 3 and 4 suggest significant differences in average efficiency for smaller banks between the pre-SAP and SAP periods. Again the results are hardly consistent in identifying the period in which this group of banks are relatively more efficient. For the bigger banks, however, in all three cases (models) where average efficiency were found to be significantly different at 5% level, pre-SAP efficiency was higher than average efficiency under the SAP era. Allthough there has not been any consistent change in the average efficiency of smaller banks the over the study horizon, for bigger banks the average efficiency has declined during the SAP when compared with the pre-SAP era.

Table 11: Bank capital adequacy, profitability, size and ownership - results of t-tests of differences in efficiency-pre and during SAP

Variables	Period	Variable no. of category	Obs	Efficiency Measures Score 1	Score 2	Score 3	Score 4	Score 5
Capital/ asset ratio	Pre-SAP	< 5%	54	0.769	0.706	0.506	0.599	0.667
		>= 5%	36	0.704[1]	0.632[1]	0.457[1]	0.613	0.677
	SAP	< 5%	57	0.715	0.632	0.556	0.491	0.623
		>= 5%	131	0.688	0.538[1]	0.500[1]	0.499	0.677[1]
Return on asset	Pre-SAP	< 2%	72	0.725	0.659	0.470	0.578	0.645
		>= 2%	18	0.816[1]	0.747[1]	0.551[1]	0.7081	0.775[1]
	SAP	< 2%	94	0.651	0.561	0.487	0.477	0.597
		>= 2%	94	0.741[1]	0.573	0.547[1]	0.5161	0.723
Asset size	Pre-SAP	< ₦500m	46	0.735	0.663	0.452	0.595	0.669
		>=₦500m	44	0.752	0.691	0.521[1]	0.614	0.673
	SAP	< ₦500m	43	0.711	0.587	0.504	0.537	0.692
		>=₦500m	45	0.692	0.561	0.521	0.4841	0.650[1]
Ownership	Pre-SAP	Private	19	0.895	0.848	0.526	0.751	0.844
		Govt.	71	0.703[1]	0.631[1]	0.4762	0.5651	0.625[1]
	SAP	Private	88	0.759	0.594	0.560	0.515	0.729
		Govt.	100	0.641[1]	0.544[1]	0.480[1]	0.4801	0.600[1]

Note: 1 signifies the significance of the efficiency score between the categories of banks or (between periods) at 5% level.

Figure 3: Profitability and efficiency in the Nigerian banking sector: 1983-1993



Bank profitability and efficiency

The profitable banks are regarded for our purpose as those with a minimum ROA of 2%. Those that do not meet this benchmark are referred to as less profitable banks. In all models except model 4, we found significant differences in the average efficiency of profitable and less profitable banks. Profitable banks have in all cases significantly higher average efficiency measures than less profitable banks. Figure 3, which plots the average efficiency measures of less profitable and profitable banks over the study horizon, brings home this distinction more vividly.

From this graph we also observe the trend in efficiency for each group of banks. As with the overall industry trend exposed in earlier sections, we see a significant and consistent decline in the efficiency of both groups of banks from 1987 to 1991 when a trend reversal took place. Table 11 shows that for each group, at least three models confirmed the significant decline in average efficiency during the SAP era.

It is possible to imagine that banks that are oligopolistic in nature, and hence earn some abnormal profit, would end up in the high efficiency category from the observed trend in Figure 3 between bank profitability and efficiency. Consequently, for an entirely competitive banking industry, the approach adopted here may fail to differentiate banks on the basis of efficiency. In which case, the oligopolistic situation may be presented as being more efficient than the competitive case.

Among the sample banks and within the Nigerian banking system, one can think of the group comprising the oldest commercial banks with foreign equity and technical

involvement as being oligopolistic in nature. There are four such banks. These banks individually exhibit among the largest asset and deposit sizes in the industry, the lowest average cost of funds and the greatest proportion of deposits in current accounts (that are stable and cheap). They are also bankers to big blue chip companies and choice clientele such as embassies, airlines and other international agencies. Their age as well as the participation in ownership by notable foreign banks has made these possible. Despite this, their profits have not been abnormal in reality. On the contrary, these banks have been plagued with board and management instability, substantial proportion of low and deteriorating quality of assets, and undue interference from the majority shareholder (the government). In very recent years, however, with their privatization, there has been evidence of a major turnaround in their performance that is sure to help them maintain their oligopolistic status and deliver real abnormal profits!

The new and smaller banks have not been as big but have been much more profitable in relative terms. Although our analysis, did not establish any clear relationship between size and efficiency, it did show a relationship profitability and efficiency. The monopoly banks did not have individual efficiency scores that were consistently higher than other banks. If anything, the opposite trend was observed. Clearly, our analysis does not present the monopoly situation as being more efficient than the competitive case.

Bank ownership and efficiency

A priori expectation here is that private banks will be more technically efficient than government banks due essentially to the fact that private banks operate strictly as profit maximizers while government banks may and often do serve as conduits for enforcing government's social responsibilities. Government banks are also thought to be plagued by unending bureaucracy that undermines their efficiency. In all cases, private banks were found to have significantly higher average efficiency than the collection of state and federal government banks. Figure 4 is perfectly consistent with this conclusion over every single year within the study horizon. Again, for both groups of banks, average efficiency has declined in the SAP period. A closer look at the graph shows a significant drop from 1987 and a trend reversal from 1991. Table 11 also confirms the observed significant difference and decline between the pre-SAP and SAP periods for private, federal and state government banks.

Bank capital adequacy and efficiency

Models 1, 2, 3 and 4 indicate the significance of average efficiency between banks with capital ratios below 5% and those with higher ratios. The test results suggest that banks with smaller capital ratios are more efficient than others. The plot of average efficiency over the study horizon for the two groups as presented in Figure 5 fails to support the test results. Between 1989 and 1991, for example, though the average efficiency of both groups of banks was on the decline, banks with higher capital ratios had higher average efficiency scores than others. In Table 11, though significant differences are confirmed to exist between both groups of banks, neither group could be said to have shown superior efficiency over the study period.

Figure 4: Private/government equity and efficiency: The Nigerian banking sector: 1983-1993

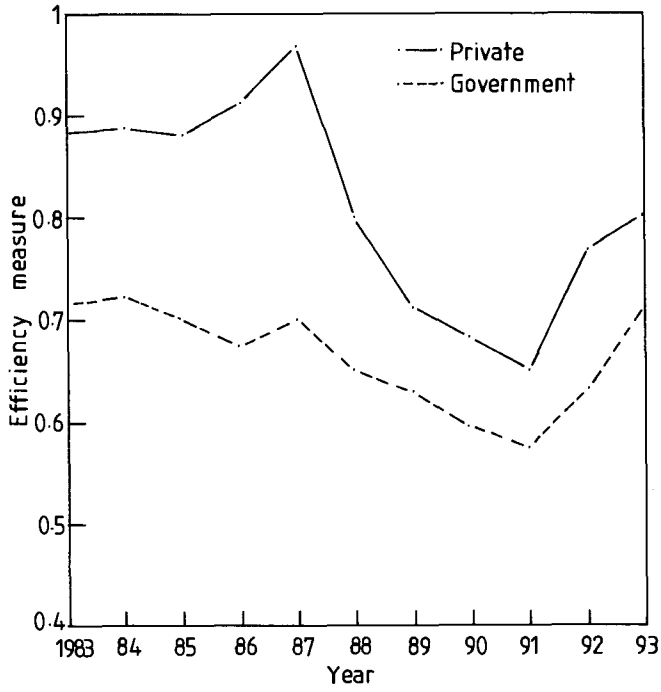
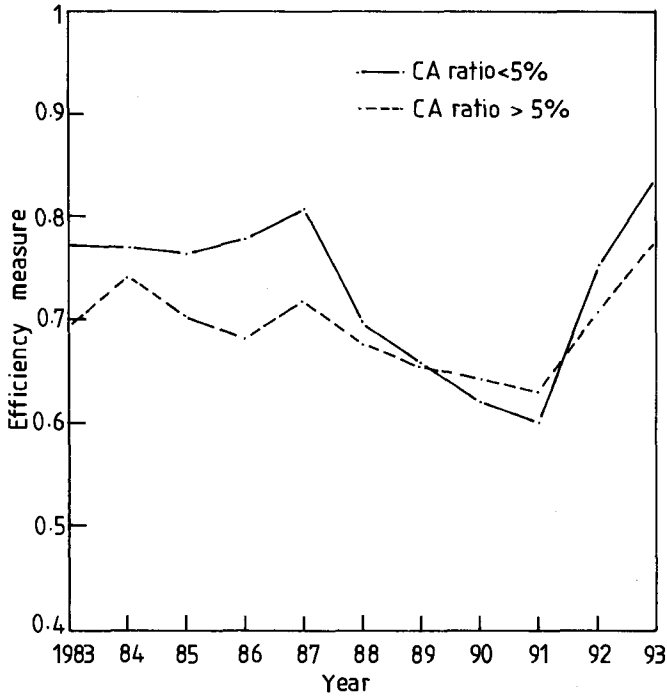


Figure 5: Capital adequacy and efficiency in the Nigerian banking sector: 1983-1993



Health status classification and technical efficiency

The appropriateness of the efficiency measures for classification of banks into the healthy and distressed categories is examined in this section. The regulatory authorities' concept of distress revolves around a bank's ability to keep consistently to its prescribed prudential and supervisory regulation. These include adherence, over the preceding three-month period, to the (1) minimum paid-up share capital, (2) risk weighted capital adequacy ratio, (3) sectoral credit allocation directives, (4) prudential regulations for recognition of low quality assets and provision for such assets, and (5) cash reserve requirements. In recent times, lateness in rendering statutory returns and incessant large and growing debit positions on a bank's account with the CBN could prompt the authorities to watchlist a bank as a candidate for ultimate distress.

The regulatory authorities have also attempted to classify banks into technically and potentially insolvent categories, perhaps in an attempt to reflect the varying degrees of distress. We would imagine that such classification would make for easier identification of each bank's ailment to enable prompt and effective treatment. Some cases have been allowed to become endemic and are now proving very difficult to resolve. Others have displayed epileptic characteristics over time perhaps due to the authorities' inability to clearly and promptly identify the causal virus and give it the appropriate prescription to be cured. A good number of banks were known to have defaulted in huge sums in the inter-bank money market while others consistently carried very low liquidity ratios. Still others were acutely under-capitalized. The reports and statement of accounts for 1993 of a good proportion of operating banks have not been released to date in spite of the fact that the statutory minimum period of six months after the financial year-end has passed. This fact is now being used as a guide by other banks and some informed customers on which banks are distressed and which can be considered healthy. This has equally guided us in identifying the class we define as vulnerable banks.[6]

We have modified our classification of banks, though the same to a large extent coincides with the healthy/distressed classification. We classify as vulnerable banks those already classified by the CBN, those that have seen one form of CBN intervention or the other in recent times, and those known to be receiving treatment from the apex body. The latter category has as some of its members banks whose financial profiles have been fragile and which are yet to release their statement of accounts after the expiration of the statutory limit. Other banks are classified as resistant to financial difficulty.

Table 12 gives information on the average efficiency measure of the different classes of banks for the pre-SAP and SAP periods. Two models suggest that average efficiency of vulnerable banks has declined significantly over the two periods. There are, however, cases in which average efficiency measures for vulnerable banks during the SAP era have exceeded those of resistant banks. The case of resistant banks has been more conclusive and convincing. Four out of the five models found a significant decline in the average efficiency of resistant banks during the SAP period.

Three of the five models confirm the significant difference in the average efficiency

Table 12: Results of t-test of differences in efficiency vulnerable and resistant banks pre and during sap

Health Status	Period	Efficiency Measures Score 1	Score 2	Score 3	Score 4	Score 5
Vulnerable	Pre-SAP	0.707	0.637	0.478	0.553	0.611
	SAP	0.675	0.575	0.500	0.484	0.617
Resistant	Pre-SAP	0.783	0.79	0.495	0.660	0.737
	SAP	0.705[1]	0.563[1]	0.525	0.502[1]	0.678[1]
Vulnerable		0.670	0.603	0.490	0.515	0.615
Resistant		0.724[1]	0.602[1]	0.517[1]	0.54[1]	0.692

Period	Health Status	Efficiency Measures Score 1	Score 2	Score 3	Score 4	Score 5
Pre-SAP	Vulnerable	0.706	0.637	0.478	0.554	0.611
	Resistant	0.783[1]	0.7191	0.495	0.660[1]	0.737
SAP	Vulnerable	0.675	0.575	0.500	0.484	0.618
	Resistant	0.705	0.564	0.525[1]	0.502	0.678[1]

of vulnerable and resistant banks over the study period. Resistant banks have higher average efficiency scores than vulnerable banks. This implies that the mean efficiency figures for the two categories of banks could then be used by regulatory authorities in conjunction with other prudential supervisory regulations such as capital adequacy to classify banks by their state of health. The adoption of benchmark efficiency scores for classifying Nigerian commercial banks by health status or strength also suggests that just as with early warning models of bank performance (Adekanye, 1993), there would be potential misclassifications. The attempt to minimize the occurrence of such misclassification will be informed by the precise benchmark to be adopted. This aspect of this study could be further pursued via discriminant and logit analysis of performance classification of Nigerian commercial banks.

Managerial efficiency and DEA technical efficiency

In the literature on bank performance, the single ratios such as operating expense to operating income and operating expense to total assets have been used to assess managerial efficiency in banks. The former considers the proportion of every naira of income spent on the average by a bank as a measure of the efficiency of the bank's management. The lower this ratio, the better the managerial efficiency of the bank. The latter ratio relates the expenditure of the bank (as an input) to its asset base (as a measure of its output). The limitation of these single ratios was emphasized earlier in this paper.

In this section we compare the single ratio measures of a bank's efficiency to what can be considered a more robust measure, the DEA technical efficiency. In a rank correlation analysis of the single ratio measure to the technical efficiency measures (as shown in Table 13), we observe for both ratios and all technical efficiency measures a negative correlation. We can appreciate this development from Tables 2 and 3 where significant increases in the single ratio measures of efficiency were observed in the SAP period, and Table 10 which shows significant decline in the technical efficiency of banks during the era of deregulation. Clearly, the single ratio measures of efficiency can hardly serve as proxy for the technical efficiency measures and vice versa. As Siems indicated, the single ratio measures are too simplistic and are devoid of sufficient information to capture the input-output relationship and characteristics of a typical bank in view of their highly aggregated nature. This result will not enable us assess the ability of the technical efficiency measures to distinguish the perforamce of banks, either singularly or in conjunction with other supervisory regulatory indicators. The basic t-test does confirm that the average efficiency of vulnerable commercial banks differs, however, and is indeed lower than that of their healthy/resistant counterparts. This at least emphasizes the relevance of the DEA measures of technical efficiency.

Table 13: Rank correlation results between single ratios and DEA measures of bank efficiency

DEA measures	Model 1	Model 2	Model 3	Model 4	Model 5
Single ratio measures					
Operating expense/ operating income	-0.378	-0.203	-0.401	-0.430	-0.560
Operating expense/ total assets	-0.378	-0.570	-0.002	-0.621	-0.331

Also, whereas the operating expense to operating income ratio was observed to be statistically significant between vulnerable and healthy banks, such a conclusion was not reached for the operating expense to total assets ratio. These results hardly make for a conclusive statement on the relevance of these single efficiency ratios. Interestingly, we observed from tables 5 and 10 the significance of single ratios of managerial efficiency as well as the DEA technical efficiency measures for distinguishing profitable from less profitable banks. This observation can be taken to point to the fact that although there may be little or no correlation between managerial and technical efficiency variables, this should not be taken to mean that neither could be useful as an indicator of an aspect of a bank's performance. The discriminant and logit models of performance can be used to examine the possibility of joint significance of these measures for capturing a greater percentage of the variation or differences in the behaviour of healthy and distressed banks. This is certainly an area for further study.

VII. A two-dimensional analysis of bank efficiency frontier: 1983-1993

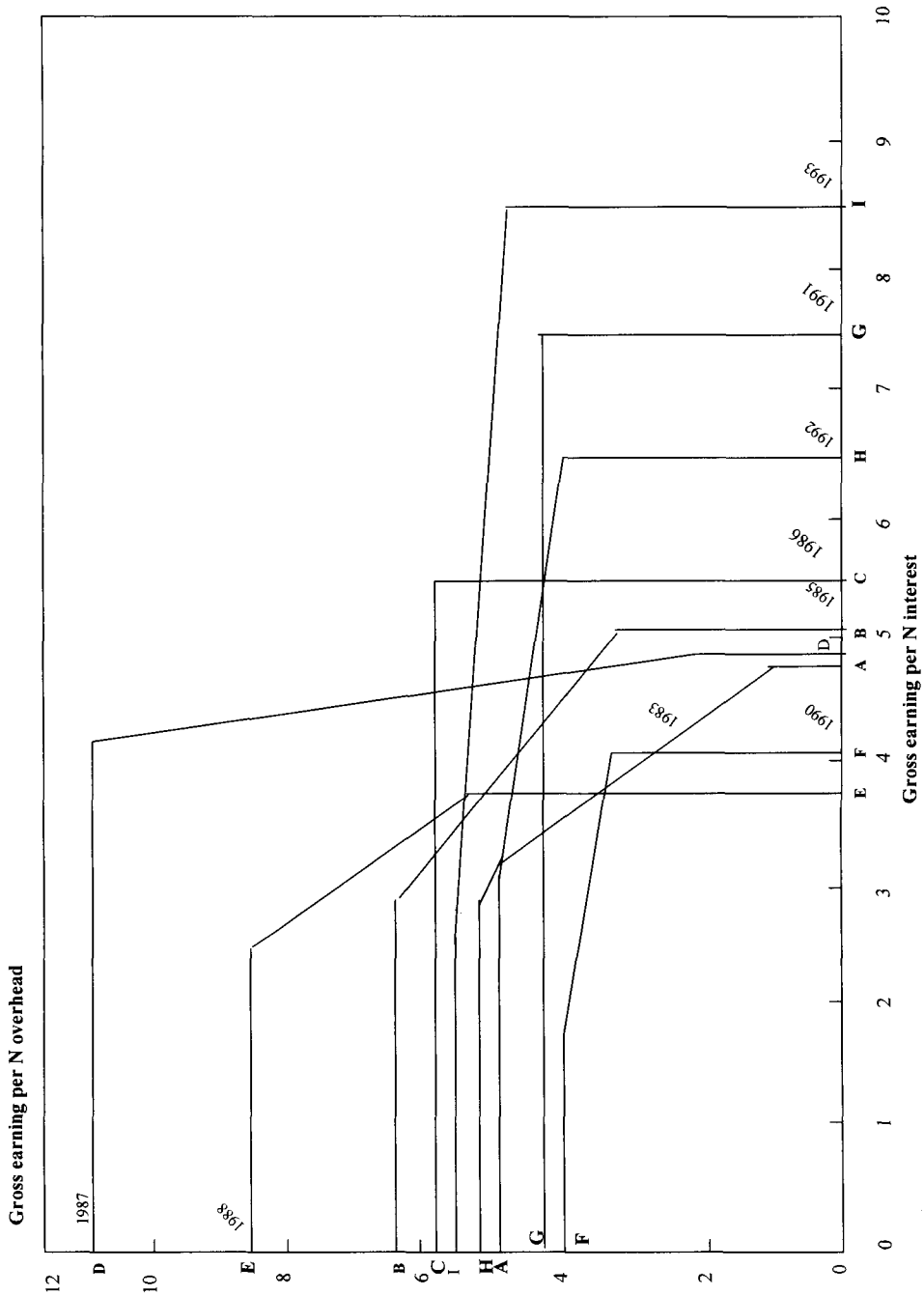
We assume for this two dimensional analysis that each bank uses two inputs, interest expense and overhead expenses (as a proxy for staff costs), to produce a single output and gross earnings. For each bank in each year of the study period, we therefore obtain the two input-output ratios. The ratios for the two inputs are graphically represented in a two-dimensional space, so that we have on the y-axis gross earning per naira of overhead expense and on the x-axis, gross earning per naira of interest expense. The higher the coordinates for a particular bank the more efficient the bank is regarded. The efficiency frontier for the group of sample banks in any specific year is obtained by joining the outer most points so that they also cut both axes thereby "enveloping" all other points. The efficiency of each bank can then be assessed by measuring how far it is from the closest point to it on the frontier.

In Figure 6 we produce the efficiency frontier for banks in each of the years within the horizon, 1983 to 1993. Each frontier is labelled to enhance identification and effective comparison over time. From this graph we observe that the efficiency frontier for 1983 is largely enveloped by that of 1984. This means in 1984 an increase in output was observed for every naira of interest expense and overhead expense, respectively. Thus, banks could be said to have witnessed increased efficiency in 1984. The trend between 1984 and 1986 is not particularly. The efficiency frontier for 1987 clearly totally envelopes all the frontiers between 1983 and 1986. This implies that every naira of interest and overhead expense (i.e., inputs), resulted in greater gross earnings (i.e., output). The frontier is pushed significantly toward the right compared with those of other banks. This significant increase in the efficiency of banks in 1987 was also observed in Figure 1 and confirmed by the statistical tests of differences in average efficiency of banks between 1986 and 1987.

The frontier for 1988 is completely enveloped by that of 1987, also reflecting a decline in bank efficiency over the period. The frontiers for 1988 and 1989 have lost height (declined along the y-axis) but gained (increased) along the x-axis. The trend is inconclusive since the loss has not been on both sides of the axes. The frontier for 1991 compared with that of 1990 shows an increase in bank efficiency as it envelopes that of 1990. The 1992 frontier overlaps slightly over that of 1991 on the x-axis showing slight improvements in the use of overhead expenses but reduced considerably on the y-axis. The frontier for 1993 envelopes that of 1990, 1991 and 1992. Following this, the efficiency of banks in 1993 could be said to have surpassed that recorded since 1990.

The somewhat simplistic analysis presented in the foregoing yields a trend very similar to that observed from the five different efficiency models over the same period. Between

Figure 6: Shifts in efficiency frontiers for Nigerian commercial banks



1983 and 1986, the changes in efficiency were not too obvious. Between 1986 and 1987, a sharp increase in efficiency was observed, followed by a decline. The upward trend in efficiency resumed in 1991, and lasted until 1993.

VIII. Conclusions and policy recommendations

Our analysis of banking system efficiency involving the comparison of pre-SAP and SAP efficiency of Nigerian commercial banks has yielded some interesting conclusions. There are indications that the efficiency of Nigerian commercial banks has tended to decline quite significantly during the period of deregulation compared with the period prior to SAP. The deregulation period has seen a remarkable change in commercial banking efficiency as measured and perceived in this study over the last ten years in Nigeria. Efficiency in resource utilization was brandied quite prominently in the debate that preceded the introduction of SAP and it was thought that this would be reflected in the banking industry, which is one of those that has witnessed such transformation in recent years. The graphical exposition of the trend in technical efficiency of banks over the study period suggests that although efficiency could be said to have been rather stable between 1983 and 1986, it surged in 1987 the first full year of the SAP era before assuming a declining trend up till 1990/91. From then it appeared to have picked up. Interestingly, the years 1991, 1992 and 1993 are three consecutive years over which reform-oriented policies could be said to have been largely consistent.

The fact that the theoretical expectation of enhanced industry efficiency was not realized should not be taken to imply the failure of the policy of deregulation. The fact that the trend over 1991 - 1993 was observed as indicated above further corroborates this. Between 1987 and 1990/91, the stream of adopted policies portrayed a fire-fighting approach to resolving unanticipated problems of the new policy regime. The changes in interest rate policy represent a good example of a policy that could have adversely affected the efficiency of banks. Indeed, interest expense as an input in the models adopted could have served as a conduit for transmitting the distortions these policies generated. It will be recalled that the last time the interest ceilings were reintroduced, banks were expected to review downward lending rates on existing facilities with immediate effect, while they were mandated to retain deposits until maturity at the high rates at which they were contracted. In this case, the system itself seemed to have been responsible for the perpetration of inefficiency in the sector.

On the other hand, the inflationary effects of the huge and growing fiscal deficit as well as the way in which it was financed could equally have affected the efficiency estimates of the model through the overhead expense input, which can be expected to be highly positively correlated over time with the rate of inflation. This trial and error approach as well as the sheer scale of fiscal indiscipline run contrary to the critical success factors identified with the policy of deregulation and in our view are capable of undermining the ability of banks to enhance their efficiency during the SAP era.

Banks' earning assets also comprise a substantial portion of what is popularly called stabilization securities. These instruments have been nothing but a vehicle for shocking or better still jolting the sector in the regulatory authorities'so-called attempt at controlling industry liquidity. These securities are dreaded by banks in that their timing and volume cannot be predicted. They cast a bottleneck on banks' ability to manage their earning assets efficiently and by implication their aggregate earnings. To the extent that the incidence of the securities across banks cannot be said to be equal, they may explain differences in efficiency not only over time (since they were introduced in 1998) but also across banks in any particular year.

We have also observed that private and government owned banks differ in their technical efficiency. The average efficiency measures are higher for private banks than for government banks. The distinction was significant for each group of banks between the pre-SAP and SAP periods. The efficiency of both categories of banks also declined during the SAP. Clearly, since efficiency of private banks exceeded that of government owned banks, it stands to reason that at least from the view point of technical efficiency- and subject to the limitations of our methodology- gains from privatization of banks may be more real than imaginary. While we may have cause to expect that privatizing government owned banks would enhance their efficiency, the declining trend in industry efficiency may be taken to suggest that given the conditions that prevailed during SAP, such banks may not have been spared from the band wagon effect of the decline.

The efficiency measures derived also significantly differed between vulnerable and resistant banks classified here in the wisdom of the healthy/distressed classification adopted by regulatory authorities. Resistant banks recorded higher average technical efficiency than vulnerable banks. The conclusion here is that in addition to other tools being adopted to monitor changes in the financial condition, the efficiency measures could as well be adopted by regulatory authorities to identify ailing banks early enough or track down deterioration in efficiency before it becomes irredeemable. These efficiency measures may be useful as a guide to off-site examiners and supervisors for tracking the health status of commercial banks. The measures may not in themselves, however, capture the full characteristics of ailing banks in view of the fact that they hardly reflect such prudential regulatory prescriptions as capital adequacy, liquidity ratio, etc. To this extent, it is suggested that they be used in conjunction with other measures to enhance the ability of bank supervisors to track developments within the industry. Identification of an industry wide decline in efficiency may also have served to alert policy makers early enough on the adverse effects of their policies.

There is an intuitively appealing argument that engaging an elaborate and costly optimization model as presented in this study for categorizing banks by health status is of littlle value. This argument draws from the fact that the conclusions reached by the model appear to support the classification used by the supervisory authorities, which is much less rigorous in application. Such an argument appears very restrictive, however, and somewhat detracts from the usefulness of the approach and results obtained in this study. This is for at least two reasons.

First, the CAMEL-driven approach as adopted by the supervisory authorities is unable to rank banks by degree of deterioration in health at any point in time or over any given

period. The approaches that rely on quantitative measures are better able to capture this important and critical need, for safety, soundness and public confidence in the sector to be consistently preserved.

Second, the basic CAMEL rating, in spite of its wide acceptability and usage, has in practice been complemented by quantitative early warning models. This makes for a more comprehensive understanding of bank performance, changes in bank behaviour, and the effect of specific policies or a menu of policies on the banking sector. Clearly, this is in recognition of the inadequacy of CAMEL and the value-added that can be derived from the adoption of more rigorous quantitative models.

Notes

1. The term deregulation has been used in this study to imply the period of consistent (or near-consistent) implementation of reform policies in the Nigerian economy. We recognize that so far at no time can the Nigerian economy be said to be deregulated. The approach has been haphazard and characterized by largely inconsistent policies though the more recent periods have witnessed greater consistency in the use of some reform policies.

2. See Siems (1992) and Yue (1992) for a more detailed mathematical and graphical exposition of the DEA methodology. Wheelock and Wilson (1994) also serves as an excellent reference.

3. One notable weakness in the choice of earning assets in the DEA model used in this study derives from the fact that it is stated net of provision for loan loss and other poor quality assets. Prior to 1991, the standards used to determine the magnitude for provisions differed considerably across banks and many, as was later recognized, made inadequate provisions for their poor quality assets. Hence, efficiency of a bank in this sense may simply reflect such under provisions and by implication overstatement of the output for a given level of inputs. What makes the series nonetheless useful is that to a very large extent, virtually all banks made inadequate provisions. Only in relative terms were there differences.

4. The note made about the tendency to overstate the maginitude of gross earnings by banks before the introduction of the prudential guidelines in 1991 has implications for gross earnings. This is because both the interest on loans that are bad will be incorporated in the profit and loss account, thereby also overstating the value of gross earnings. Again, this has been the case with virtually all banks. This tendency has been greatly reduced during the 1990s.

5. We have not checked on the sensitivity of the DEA efficiency measures to changes in number of banks and over time in this study. This would involve computing the efficiency measures over much shorter subperiods rather than pooling over many years as we have done here. By computing the efficiency measures on an annual basis, for example the number of banks included would have changed and the effect of this could be assessed. The sensitivty of the methodology to the choice

of inputs and outputs can be determined from the results of other models adopted in this study.

6. In the more recent periods of the study, we excluded banks that are yet to release their annual reports. Data on the financial condition of such banks were used in the earlier periods for which they were available and during which the banks were perhaps yet to be classified as distressed.

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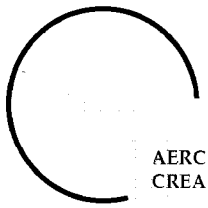

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